NEWSLETTER

Homebrew Computer Club

Robert Reiling, Editor □ Post Office Box 626, Mountain View, CA 94042 □ **Joel Miller**, Staff Writer

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RANDOM DATA

By Robert Reiling

MEETING—Nov. 12, 1976. Acapacity crowd was on hand, estimated at over 450 people for this meeting. Anderson Jacobson, Inc. had their terminals and, as promised, provided an informative talk about the Selectric machine as used in their terminals. Particularly interesting was the discussion of the way that the type ball is positioned to print a character. Also, the differences in the I/O unit as compared to the office unit were listed. The I/O Selectric is a heavy duty machine developed for computer use and workloads. The office Selectric does not have the heavy duty features.

M&R Enterprises demonstrated the Astral 2000 with the special version of BASIC which has been specifically designed to operate in the Astral system. The Astral is available in fully assembled, turn-key condition as a partially assembled kit. The kit saves a lot of money and is easy to put together since the majority of the electronics are preassembled, burned in and tested. Marty Spergel and other representitives from M&R discussed these and other features of this computer system. If you missed the meeting you may obtain Astral 2000 information by writing M&R Enterprises, P.O. Box 61011, Sunnyvale, CA 94088.

S-100 SYSTEM SYMPOSIUM—Nov. 20, 1976. Well over 100 people attended the S-100 System Symposium held at Diablo Valley College. Three perspectives were given by Dr. Harry Garland, George Morrow and Lee Felsenstein. It was noted by Lee Felsenstein that a large variety of products are available that utilize this bus. Harry Garland pointed out that the bus system is basically a good product. George Morrow discussed the complex nature of the bus. A panel discussion, moderated by Jim Warren, brought out a number of opinions but the panel generally agreed the S-100 bus system will be used for several years because so many products use it. In order to get better definition of bus signals and electrical requirements, it was suggested that publishers print more bus information and act as a clearing house for comments.

This was the first symposium held covering the S-100 system. It was very well done and certainly informative to all in attendance. Indeed, it seems everyone must have learned something new. The organizers Dr. W. J. Schenker, and R. J. Hendrickson are to be congratulated.

MORE ON THE S-100—April, 1977. The First West Coast Computer Faire being held April 15-17, 1977 at the San Francisco Civic Auditorium, Northern California's largest convention facility, will have a conference session on the S-100 bus according to Jim Warren, Faire Chairperson. You can participate in this session or others scheduled for the Faire. Write or call Jim Warren, Box 1579, Palo Alto, CA 94302, (415) 851-7664 or 323-3111.

LETTER—November, 1976. Samuel H. Daniel, Vandenberg AFB, CA sent a letter asking to be put on the mailing list and enclosed a donation. He commented as follows on his activities, "I presently have an 18K Digital Group 8080 System, to which I may add a pair of Phi-Decks and a controller. It works as advertised and went from bits and pieces to assembled and tested in only 14.5 hours. Needless to say, I'm pleased with and recommend it." Thank you for the product information and for the contribution to the Newsletter.

CONTRIBUTIONS—The Homebrew Computer Club Newsletter is supported by contributions, both of articles and money. Your articles help keep information flowing and all of us benefit. In this issue you will read about what others are doing with their computers. What are you doing? Do you have a favorite software idea? How about a product evaluation? Send me your article for the Newsletter.

Money, of course, is another requirement of the Newsletter. Printing and postage are very expensive and so it follows the Newsletter costs a reasonable amount to produce and distribute. Please keep your contributions coming in. Mail to Homebrew Computer Club Newsletter, P.O. Box 626, Mountain View, CA 94042 or meet me at the next Club meeting. □

ONE MAN'S SYSTEM

By Charlie Pack

My background is in programming, including 10 years of experience mostly on large-scale IBM systems. I've used IBM 1401 Autocoder, IBM 360 Assembler, PL/1 and COBOL for many varied applications, including some of my own personal accounting and inventory chores. In 1973 I went to work for an electronics

firm which manufactures intelligent terminals using the then-new Intel 8008. Although I didn't program the 8008, it soon became apparent to me that microprocessors were good for a lot more than just formatting data on a video screen or controlling traffic lights.

In the meantime, I had gotten interested in digital electronic circuitry while building digital clocks and meters, and finally I built and got running a Radio-Electronics "TV Typewriter" (the TVT-1, with the boards that are stacked like cordwood). Then the bug hit me for sure—I wanted my own computer. So in November 1975 I devised a point system and rated all of the available hobbyist computers.

I had been renting time on an IBM 360/30 ffor $30 per hour, so I wanted the capability to run a high-level language and later a disk operating system. The clear winner was determined using my point system and right after New Year's my Altair 8080 kit arrived (when I ordered my Altair I didn't know about the IMSAI computer).

At the present time I have up and running in my Altair a Processor Technology motherboard, 3P+S I/O interface, two 4KRA static memories and two 4K dynamic memories. I use an ASR-33 Teletype machine for I/O. MITS BASIC version 3.2 is used for all accounting applications at present.

The aforementioned hardware is now being used to do investment portfolio and income tax analysis and to produce a cross-reference index to magazine articles. The hardware now being used represents a practical minimum for the performance pf the applications now being run.

Assuming that the necessary planning and analysis has been done, computer inplementation of most simple business-type applications not involving large amounts of data involves four basic needs:

a) Some means of transferring original data from documents to the computer. For an on-line system this is done using a suitable keyboard and some type of edit/update program.

b) Some means of storing the data outside of computer memory.

c) Processing of data, usually involving data selection or sorting logic and calculations.

d) Reporting of the desired information to the user. This is the end product of the sytem.

The BASIC line editor itself satisfies the first two needs in my applications. Here is a complete on-line data entry program which can add new data, change existing data and delete data. Of course, the entire data file is in memory, but allowing 6K for BASIC and 4K for a good-sized program (leave out comments and use multiple statements per line to save memory space), leaves 6K bytes remaining for data.

That's enough for 100-150 transactions with 3-6 data items per transaction, using DATA statments. A year's investment portfolio transactions are no problem! I use line numbers of 10000 and up for DATA and less than 10000 for program code. The command LIST 10000 stores the updated data file on paper tape.

The latter two needs are satisfied by programs I write in BASIC and use with the printer on my ASR-33. By following set conventions for line numbers and by using common subroutine for READing data, a programmer may use a DATA file with several programs. To print out or punch the program code only, I type LIST and when the last statement starts to print I hit control-C a couple of times to stop it.

Although my implementation of investment portfolio is crude, it illustrates that minimum hobbyist-type equipment can be practically utilized for many small business needs. A video display such as the Processor Technology VDM-1 and a tape cassette storage system could be substitued for—or used in addition to—the ASR-33. The use of Extended BASIC would greatly facilitate separate storage and manipulation of data and programs and the display of formatted reports.

My future plans, as far as hardware is concerned, include the acquisition of more memory, a ROM monitor which can be used to load BASIC, a video display, cassette tape interface and hardware backup capability. By the time this article is in print, I will have a Processor Technology 8KRA RAM board and a MITS PROM board up and running, with a system monitor in six 1702A PROMs. The latter has loaders for MITS BASIC (any version) and for software in the Intel hex format, a block move, full TTY support, and switchable hexidecimal or octal mode capability, in addition to normal monitor functions. It will be made available to hobbyists via the HBCC library and through the Byte Shop in Santa Clara.

My future plans for software include enhancement of the monitor to support tape cassette I/O and some type of video monitor display. Memory diagnostics, games and other programs will be developed for use with the run on a cross-assember of my own design and written in ANSI COBOL for execution on a medium- or large-scale system. A suitable alternative to this would be a Processor Technology ALS-8 development system and a DECwriter or similar printer, if the latter could be obtained at a reasonable cost.

I would be interested to hear from other hobbyists as to what they would like to see in the way of software for the 8080 or Z80. How about a full operating system for multiple cassette tape drives? What features would you like it to have? Is there an interest in games (such as Star Trek) in machine language for small-capacity systems? I can be reached at 25470 Elena Rd., Los Altos Hills, CA, 94022. Home phone (415) 941-0495, between 7 and 10 p.m. on week-day evenings would be preferred. □

WISCONSIN AREA COMPUTER SOCIETY

By Robert Reiling

The Wisconsin Area Computer Society has been holding monthly meetings for the last twelve months and has a paid membership of over 80 persons. They are establishing a good software library, and can communicate via Cassette Tape (Tarbell, Digital Group and K. C. Standard) and Paper Tape. Recently they published their first newsletter. Contact Don Stevens, Chairman, Wisconsin Area Computer Society, P.O. Box 159, Sheboygan Falls, WI 53085. □

GETTING THE MOST OUT OF TINY BASIC

Tom Pittman

Continued from last issue.

Execution Speed

TINY BASIC is actually quite slow in running programs. That is one of the hazards of a two-level interpreter approach to a language processor. But there are some ways to affect the execution speed. One of these is to use the keyword "LET" in your assignment statements. TINY BASIC will accept either of the following two forms of the assignment statement and do the same thing,

```
R=2+3
LET R=2+3
```

but the second form will execute much faster because it is unnecessary for the interpreter to first ascertain that it is not a REM, RUN or RETURN statement. In fact, the LET keyword is the first tested, so that it becomes the fastest-executing statement, whereas the other form must be tested against all twelve keyboards before it is assumed to be an assignment statement.

Another way to speed up program execution depends on the fact that constant numbers are converted to binary each time they are used, while variables are fetched and used directly with no conversion. If you use the same constant over and over and you do not otherwise use all the variables, assigning that number to one of the spare variables will make the program both shorter and faster. You can even make the assignment in an unnumbered line; the variables keep their values until explicitly changed.

Debugging

Very few programs run perfectly the first time. When your program doesn't seem to run right there are several steps you can take to find the problem.

First of all, try to break it up into its component parts. Use the GOTO command and the END statement to test each part separately if you can. Add extra PRINT statements along the way to print out the variables you are using; sometimes the variables do not have the values in them that we expected. Also the PRINT statements will give you an idea as to the flow of execution. For example, in testing the sort of program above (lines 500-700) I inserted the following extra PRINT statements:

```
525 PR "x";
545 PR "."
555 PR
```

This gave me an idea where in the sort algorithm I was, so I could follow the exchanges (the "x"s), where each line represented one pass through the main loop. Endless loops become more obvious this way.

If you have not used all the sequential line numbers, you can insert breakpoints in the program in the form of a line number with an illegal statement—I like to use a single period, because it is easy to type and does not take much space:

```
10 LET A=B+1234
11 .
20 GOSUB 100+A
```

Here, when you type RUN, the program will stop with the error message,

```
!184 AT 11
```

Now we can PRINT A, B, etc., to see what might be wrong, or type in GOTO 20 to resume, with no loss to the original program.

As we have seen, there is not much that TINY BASIC cannot do (except maybe go fast). Sure, it is somewhat of a nuisance to write all that extra code to get bigger numbers or strings or arrays, but you can always code up subroutines which can be used in several different programs like the floating point add above (line 1000-1250), then save them off on paper tape or cassette.

Remember, your computer (with TINY BASIC in it) is limited only by your imagination.

REFERENCES:

(1) *TINY BASIC User's Manual.* Available from Itty Bitty Computers, P.O. Box 23189, San Jose, CA 95153.
(2) *Doctor Dobb's Journal*, No. 7, p. 26. Available from PCC, P.O. Box 310, Menlo Park, CA 94025.

Finally it should be noted that GOTOs and GOSUBs always search the program from the beginning for their respective line numbers. Put the speed-sensitive part of the program near the front, and the infrequently used routines (set-up, error messages, and the like) at the end. This way the GOTOs have fewer line numbers to wade through so they will run faster. □

INEXPENSIVE GRAPHICS

Workshop Announcement

A workshop regarding inexpensive graphics is being planned on the East Coast. It will be held next year and is sponsored by Sigraph of the A.C.M. Interested people may contact William Etra, 42 E. 23rd Street, 7th Floor, New York, NY 10010. □

ABOUT RECONNECTING THE IMSAI POWER TRANSFORMER

By Dave Kinkade

When I changed the line input connections to my IMSAI transformer (a Trane 3751), I was chagrined to learn that it did not match the diagram on the PS-B schematic (Rev. 2, 3/3/76).

The terminals are actually: (1) common, (2) for 105 V, (3) for 115 V, (4) for 125 V. For example, I connected to (1) and (4) instead of (1) and (3) to lower the output voltage and generate less regulator heat. □

THE FIRST
WEST COAST
COMPUTER FAIRE
A Conference & Exposition
on
Personal & Home Computers
april, 1977 · san francisco
P.O. Box 1579, Palo Alto, CA (415) 851-7664, 323-3111

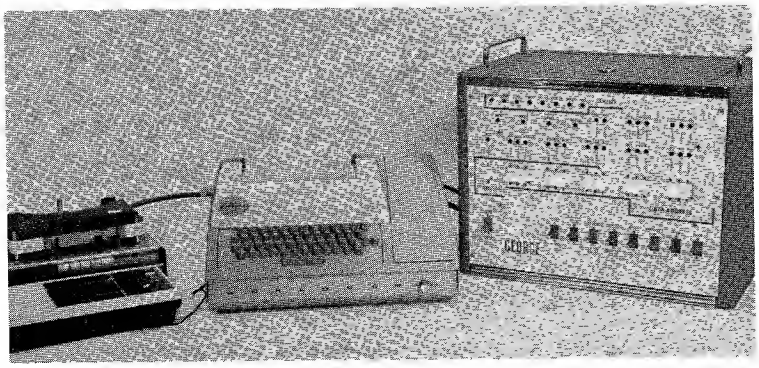
HOW I BUILT MY FIRST COMPUTER, OR FOOLS RUSH IN WHERE ENGINEERS FEAR TO TREAD

By Norman Walters

A course, "Introduction to Computing," taken during the fall of 1975 was my first exposure to the wonderful world of computers. By mid-term, the itch to have my own was beginning to be felt. The itch faded considerably when the prices of the computer kits on the market was considered. After much thought, I decided one could be built at home at a price my wife would not be able to use as grounds for divorce. Naturally, the fact that the largest project previously tackled was a digital clock did not cool my optimism a whit.

Ten months later my home brew computer is built and the cost was much smaller than if a commercial kit had been purchased, but the time and effort expended have been tremendous.

During the construction of GEORGE, every cost-cutting trick possible was employed. Naturally, the mother board was built from scrap cut-offs bought at the club, and 80-pin connectors were cut to form 100-pin connectors. Every friend I had plus some who had not realized that we were even on speaking terms was presented with a list of parts needed and a strong hint given, "If you have any of these parts just lying around, you might be able to force me to take them off your hands if the price is right!" I haunted all the surplus electronics stores and pored over the Poly Pak catalog like it was a dirty book. Because of this approach (cheap), parts did not present a major problem. The CPU board and control panel board required the largest outlay of time. After some initial delays, both were purchased through the club by group buy.

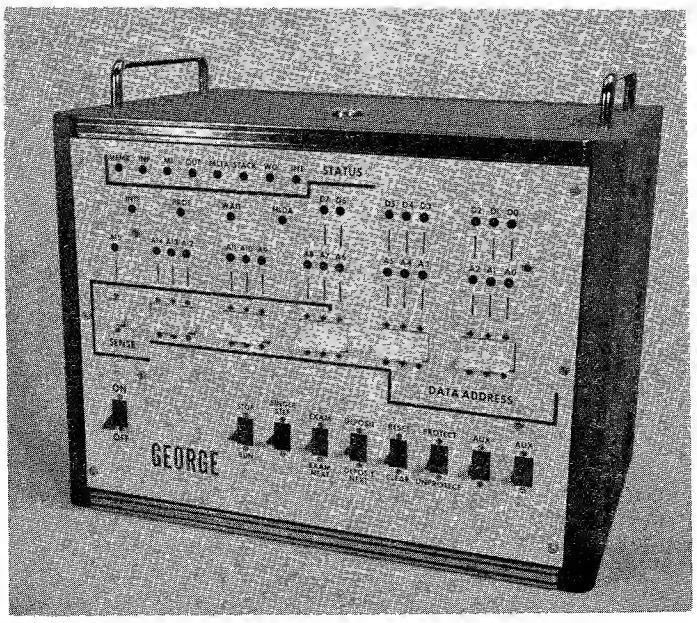


Building the boards up took relatively little time. The largest block of time during construction was devoted to running wire. A total of nearly 1,000 feet of 26 ga. and 100 feet of 16 ga. was used. Checkout was prolonged considerably by the unfortunate insertion of the CPU board backwards in the motherboard. The snaps, crackles and pops would have done Rice Krispies up proud. Invaluable assistance by a long suffering friend, Grant Connell, finally got GEORGE up and running.

The system at the present time consists of the 8080 microcomputer with 24K of 2102 RAM, 12K of 1702A EPROMs, a KSR-33 Teletype, a cassette recorder, I/O boards for the teletype and cassette plus a high speed paper tape punch. Within the next six weeks, GEORGE will acquire a high speed paper tape reader and a VTT 4000B video terminal.

I can tell the memory of the pain, sweat and frustration incurred during the construction is beginning to fade. A few weeks ago, I saw the ad for the Micro Nova minicomputer chip set and thought, "Why, I bet that I can get one of those jewels up and running for almost nothing!"

By the way, I have a list of parts that you have probably got just sitting around gathering dust.... □



TINY BASIC OR HOW MY FAMILY CAME TO LOVE MY COMPUTER

By Ray Boaz

One sure way to get the support of your family for all the hours that you spend with your computer (only) is to let them get some "hands on" time. The problem is how many kids, let alone wives, understand binary, octal, hex or getting a program into the %$&† thing to do something. So how do you do it? Well I got Tiny BASIC for my AMI Proto system (by Tom Pittman) and it worked out just great.

The first thing I did was write a program for my nine year old girl, Heidi, to use for her multiplication facts. After one minute she was really into it. The program generates two random numbers less than twelve, prints them (i.e. 9 x 11 =), waits for the product to be typed in, and then compares the entered product to the calculated product. If the answer is correct a new line is given. The computer can keep score and if the problem was a "hard" one, a "VERY GOOD" is printed. This is a short and simple program, but to a nine year old girl, it is like magic.

I didn't get off that easy, however. At my side all the time (or was it on top of me) was my son, Chip, who is only six. Since he is not up to multiplication yet I had to do something else. If Tiny BASIC could multiply that easy, it must be at least as easy to do the addition facts. So with a few chnges in the same program, another member of the family was into the computer.

Well, that accounts for two out of three. What about my wife? Glad you ask. She does not glare at it when she walks by and has even started saying some almost nice things about it. If this keeps up, I may have to start on another computer for myself.

Oh, one other thing. Heidi is busy setting up times for her friends and making arrangements to take the new toy to school. There seems to be no end of what can happen when your kids can compute. □

BULLETIN BOARD

For sale: Cryptographic program that will baffle the codebreakers of the CIA. ENCODE and/or DECODE your private correspondence for maximum security. Documentation of cypher technique, program listing and punched paper tape in BASIC for only $6. Jon Stedman, 1528 Summit Rd., Berkeley, CA 94708.

Kleinschmidt 311 printer, 40 char/second, 80 characters wide, parallel ASCII input, level conversion from -12 V can be tapped from printer power supply, full documentation, has modem card, automatic shut-off after 60 seconds of no data, good operating condition, needs cleaning, $300; another 311, has power supply, no other electronics, excellent mechanical condition, $150; extensive supply of spare parts, $50; all of the above together, asking $400; Wm J. Schenker, M.D., 2086 Essenay, Walnut Creek, CA 94596, (415) 939-6296.

Computer store opens in Sunnyvale—recreational Computer Centers, 1324 South Mary Ave., Sunnyvale, CA 94087. Phone 735-7480.

CLUB LIBRARY

Gordon French, club librarian, has lots of interesting material and is able to loan it to anyone with a definite need, but . . . *please adhere to the following:*

☆Limit your telephone calls to the hours of 7PM to 9PM weekdays only. This is important. Gordon's phone number is (415) 325-4209 in Menlo Park.

☆Be specific with your requests and Gordon can probably help you—he cannot randomly review the contents of the library for you.

☆No reproductions will be made of any materials.

☆All materials loaned must be returned so they are available for others to use in the future.□

For Sale: IMSAI 8080, 8K Dutonics memory, Polymorphic video terminal interface, Tarbell cassette interface, Altair 2SIO with one port, keyboard and J. C. Penny audio cassette recorder. Assembled. $1775. Contact J. Gill, 497-4715 (days), 321-6289 (evenings).

SOL User Group now forming. If you own or have ordered Processor Technology's SOL computer, please send your name, address, phone number and ideas to Bill Burns, 4190 Maybell Way, Palo Alto, CA 94306.

Wanted—Carpool or riders to Fairchild (or Ellis St. area in Mountain View from the Summit Rd. area in the Santa Cruz mountains. Must be willing to get going early as I like to avoid traffic. Joel (415) 962-3372 (days) or (408) 353-2663 (eves).

HOW TO GET THE NEWSLETTER

Anyone interested in computers as a hobby may receive the *Newsletter* by sending a request to the **Homebrew Computer Club Newsletter,** P.O. Box 626, Mountain View, CA 94042. The *Newsletter* is distributed monthly at the club meetings and is also mailed to individuals who are unable to attend the meetings.

If you have an input to the *Newsletter*, send it in and it will be published as quickly as possible. However, the editors cannot promise that everything sent will be published immediately. All manuscripts must be typed and carefully proofed. All listings and diagrams should be as clear and easy to read as possible.

The *Newsletter* is made possible by your donations. Please remember that we must pay for postage, labels and printing. Donations may be given to **Ray Boaz** at the club meetings or sent to the above address.□

STAND-ALONE ADAPTER FOR VDM-1

By Lee Felsentein

This circuit allows the operation of the Processor Technology VDM-1 as a stand-alone terminal. It includes a UART for serial data communication with EIA RS-232 signal levels. All data to the VDM comes through the UART, so a "local loopback" connection is necessary from the Data Out terminal to the Data In for half duplex operation. Two switchable Baud rates are available if a SPDT switch is connected to switch Baud Rtn to Baud 1 or Baud 2. The Ready output from the UART allows operation from a generalized parallel interface at maximum speed. The Break input moves the output to a space condition and is used as an escape character in various systems.

The circuit requires a connection to an external -16 V to -19 V supply; +5 V power is supplied by pin 16 of IC23 from the regulator of the VDM. The circuit draws very little current since most logic is CMOS. The -12 V and +5 V connections shown are for keyboard power.

On power-up, the circuit initializes to a clear screen with a cursor in the lower left corner. Non-control characters are displayed and rolled up when a 64 character line is filled. CR will terminate a line and roll it up. A LF immediately following the CR will be ignored, as will a LF following any number of DEL (rubout) characters which in turn follow a CR. A second LF, or one without a CR preceding, will be treated like a CR-LF combination. FF will initialize the screen.

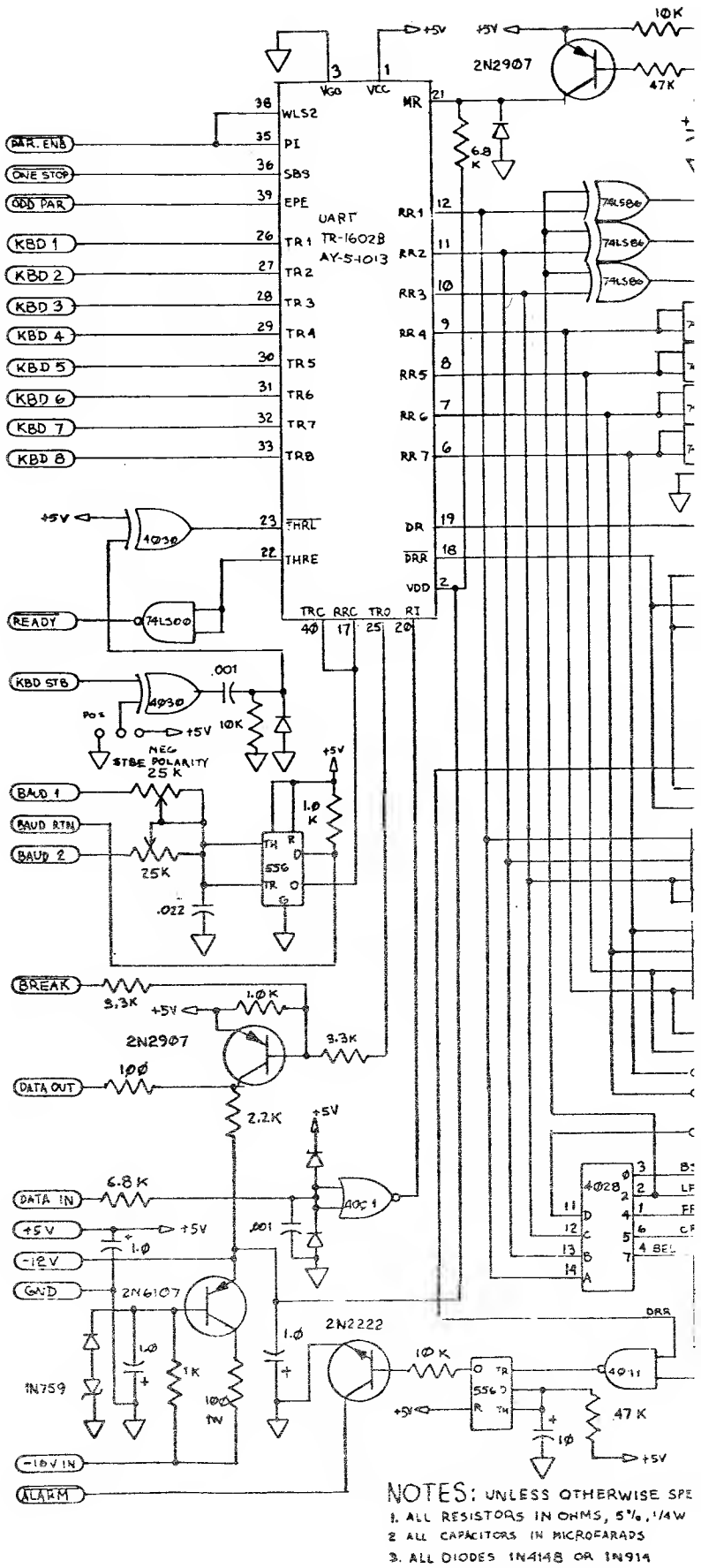
BS will be recognized and the cursor will move back and will erase the last character. At the left end of the line the cursor will jump to the right end and will cause a roll down of the line above. This will not occur if there is not text on the line above. The cursor will jump to the 64th location whether or not it is visible there. If the previous line was terminated by a CR, the cursor disappears until backed over the CR.

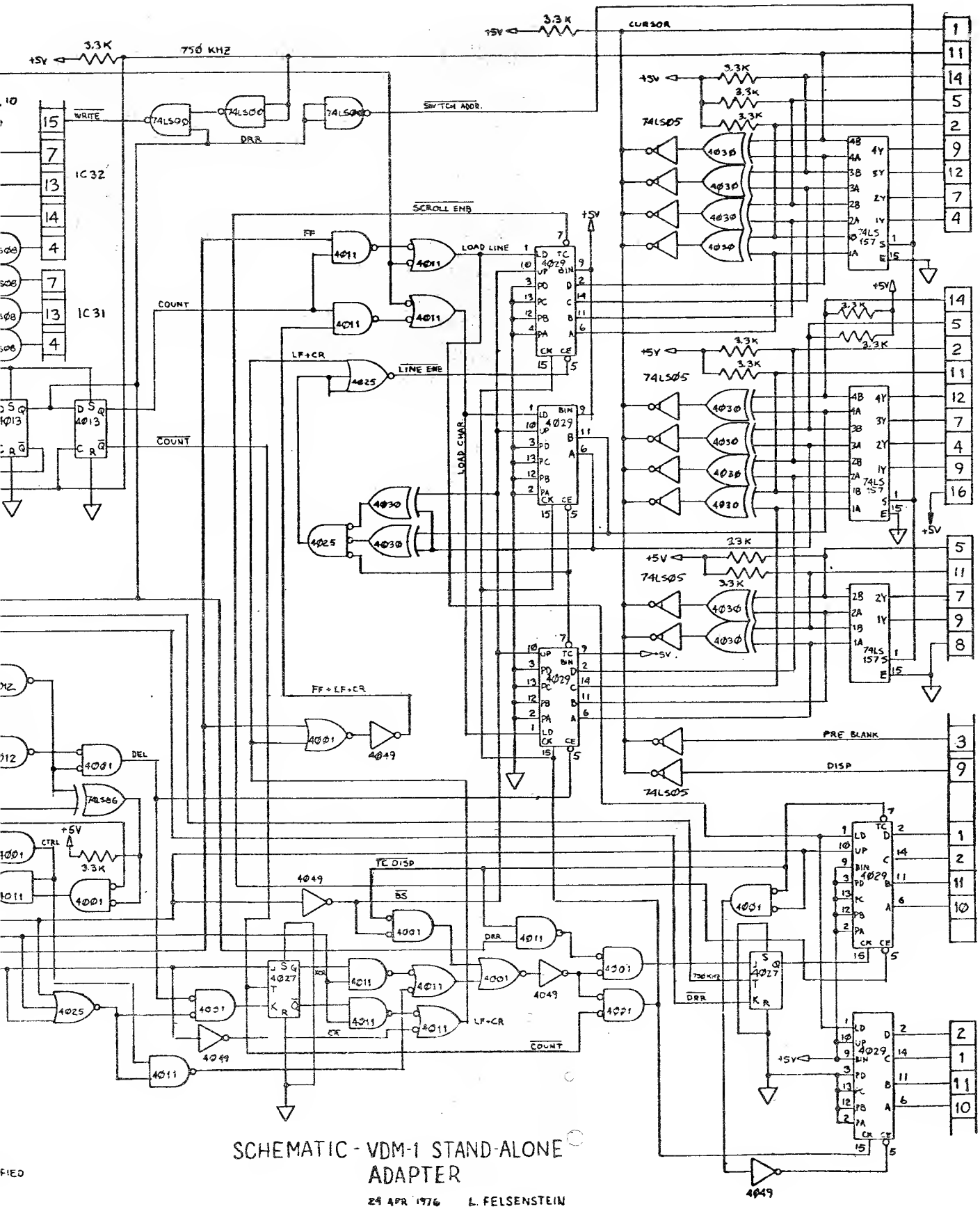
The circuit may be constructed using wire-wrap or solder; layout is not critical except that proper supply bypassing techniques must be used for the TTL ICs. Capacitors (0.1μF) should be connected between the +5 V and GDN pins of these ICs to prevent supply current pulses.

The two boards may be interconnected with ribbon cables and DIP headers which plug into the IC sockets indicated on the drawing.

THE FOLLOWING MODIFICATIONS TO THE VDM ARE NECESSARY

1. Cut trace on solder side from pin 4 of IC 17.
2. Cut trace from pin 13 of IC 10 on component side.
3. Connect a jumper from pin 6 of IC 17 to pin 13 of IC 10.
4. Connect a jumper from pin 7 of IC 31 to pin 4 of IC 17.
5. Connect a jumper from pin 3 of IC 31 to pin 7 of IC 13.
6. Connect a jumper from pin 8 of IC 15 to pin 9 of IC 31.
7. Connect a jumper from pin 3 of IC 41 to pin 15 of IC 31.
8. Remove ICs 18, 23, 24, 28, 29, 31, 32, 33, 34, 35, 37, 38, 39 and 40.
9. If not yet installed, resistors R27 through R32 and R41 through R48 may be omitted from assembly. □

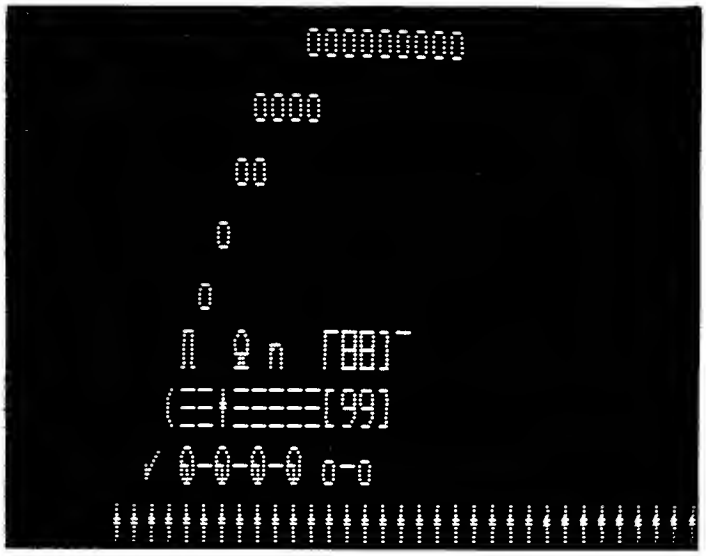




SCHEMATIC - VDM-1 STAND-ALONE ADAPTER

24 APR 1976 L. FELSENSTEIN

GORDON FRENCH'S CHOO-CHOO TRAIN
OR
IDLE FANTASIES ON A VDM SCREEN



```
0000                    0000
0000                    0010
0000                    0020
0000                    0030
0000                    0040
0000                    0050
0000                    0060
0000                    0070 *
0000 AF                 0080 TRAIN  XRA     A       ONCE UPON A TIME,
0001 D3 C8              0090        OUT     0C8H    IN A CURIOUS LITTLE
0003 21 84 01           0100        LXI     H,SHED   PLACE THERE WAS "
0006 01 00 08           0110        LXI     B,2048   ..A TINY TRAIN
0009 36 20              0120 EMPTY  MVI     M,20H   .. AND IT STAYED IN A
000B 23                 0130        INX     H       .. TINY SHED
000C 0B                 0140        DCX     B       .. THAT WAS ALL EMPTY
000D AF                 0150        XRA     A
000E A8                 0160        XRA     B
000F C2 09 00           0170        JNZ     EMPTY
0012 21 F7 02           0180        LXI     H,CLOUD  ..EXCEPT FOR A HUGE
0015 11 00 00           0190        LXI     D,0
0018 06 0E              0200        MVI     B,14    B
001A CD 50 00           0210        CALL    SM01     I
001D 11 2B 00           0220        LXI     D,43      L
0020 06 0C              0230        MVI     B,12       L
0022 CD 50 00           0240        CALL    SM01        O
0025 11 30 00           0250        LXI     D,48         W
0028 06 09              0260        MVI     B,9           Y
002A CD 50 00           0270        CALL    SM01
002D 11 34 00           0280        LXI     D,52              C
0030 06 04              0290        MVI     B,4                L
0032 CD 50 00           0300        CALL    SM01                O
0035 11 3B 00           0310        LXI     D,59                 U
0038 06 02              0320        MVI     B,2                   D
003A CD 50 00           0330        CALL    SM01
003D 11 3C 00           0340        LXI     D,60                      O
0040 06 01              0350        MVI     B,1                        F
0042 CD 50 00           0360        CALL    SM01
0045 11 3E 00           0370        LXI     D,62                           S
0048 06 01              0380        MVI     B,1                             M
004A CD 50 00           0390        CALL    SM01                             O
004D C3 59 00           0400        JMP     ENGIN                             K
0050                    0410 *                                                   E
0050 19                 0420 SM01   DAD     D
0051 36 6F              0430 SM02   MVI     M,SMOKE  ..COUGH
0053 23                 0440        INX     H
0054 05                 0450        DCR     B               ..COUGH
0055 C2 51 00           0460        JNZ     SM02
0058 C9                 0470        RET     *       COMING OUT OF THE STACK
                                                    OF
```

```
0059
0059 21 A6 04
005C 36 16
005E 21 A9 04
0061 36 07
0063 21 AB 04
0066 36 6E
0068 2A 66 01
006B 22 AE 04
006E 2A 68 01
0071 22 B0 04
0074 2A 6A 01
0077 22 B2 04
007A 2A 6C 01
007D 22 E5 04
0080 2A 6E 01
0083 22 E7 04
0086 2A 70 01
0089 22 E9 04
008C 22 EB 04
008F 2A 72 01
0092 22 ED 04
0095 2A 74 01
0098 22 EF 04
009B 2A 76 01
009E 22 F1 04
00A1 2A 78 01
00A4 22 24 05
00A7 2A 7A 01
00AA 22 26 05
00AD 22 28 05
00B0 22 2A 05
00B3 2A 7C 01
00B6 22 2C 05
00B9 2A 7E 01
00BC 22 2E 05
00BF 2A 80 01
00C2 22 30 05
00C5 01 DF FF
00C8 21 62 05
00CB 36 19
00CD 03
00CE 23
00CF AF
00D0 A8
00D1 C2 CB 00
00D4 21 00 CC
00D7 EB
00D8 21 84 01
00DB 7E
00DC 23
00DD EB
00DE 77
00DF 23
00E0 7C
00E1 EB
00E2 FE D0
00E4 C2 DB 00
00E7 CD ED 00
00EA C3 D4 00

0480 *
0490 ENGINE LXI   H,SHED+322H  A TINY LOCOMOTIVE
0500        MVI   M,16H  WITH A LITTLE SMOKESTAK
0510        LXI   H,SHED+325H  AND A LITTLE BELL
0520        MVI   M,07H
0530        LXI   H,SHED+327H  ..AND A TINY DOME
0540        MVI   M,6EH
0550        LHLD  CAB1    .. AND A CAB
0560        SHLD  SHED+32AH WITH WINDOWS
0570        LHLD  CAB2    .. SO THAT YOU COULD
0580        SHLD  SHED+32CH SEE INTO WHERE THE
0590        LHLD  CAB3    .. ENGINEER AND THE
0600        SHLD  SHED+32EH FIREMAN SAT.
0610        LHLD  BOI1    .. IT HAD A BEAUTIFUL
0620        SHLD  SHED+361H POLISHED
0630        LHLD  BOI2    .. BRASS
0640        SHLD  SHED+363H BOILER
0650        LHLD  BOI3    .. WITH
0660        SHLD  SHED+365H THE NUMBER
0670        SHLD  SHED+367H "99" ON THE
0680        LHLD  BOI4    .. SIDE OF
0690        SHLD  SHED+369H THE CAB
0700        LHLD  BOI5    .. BUT YOU COULDN'T
0710        SHLD  SHED+36BH SEE EITHER THE
0720        LHLD  BOI6    .. ENGINEER OR THE
0730        SHLD  SHED+36DH FIREMAN
0740        LHLD  FRA1    .. THE LITTLE ENGINE
0750        SHLD  SHED+3A0H ALSO
0760        LHLD  FRA2    .. HAD A COWCATCHER
0770        SHLD  SHED+3A2H AND LOTS OF FUNNY
0780        SHLD  SHED+3A4H WHEELS AND THE
0790        SHLD  SHED+3A6H THINGS THAT CONNECTED
0800        LHLD  FRA3    .. AND TWO VERY TINY
0810        SHLD  SHED+3A8H WHEELS AT THE VERY
0820        LHLD  FRA4    .. VERY BACK
0830        SHLD  SHED+3AAH ALTOGETHER IT LOOKED
0840        LHLD  FRA5    .. QUITE LONELY AND YET
0850        SHLD  SHED+3ACH IT APPEARED VERY
0860        LXI   B,-21H  . FUNNY JUST SITTING
0870        LXI   H,SHED+3DEH THERE ON THE
0880 RAILS  MVI   M,19H   .. RAILS
0890        INX   B       .. WITH NOTHING AT ALL
0900        INX   H       .. EVER
0910        XRA   A       .. TO DO
0920        XRA   B       ..   W E L L !
0930        JNZ   RAILS   .. LET'S RUN IT JUST FOR
                            FUN
0940 HOSTL  LXI   H,RRY   GET TRAIN OUT OF SHED
0950        XCHG  .       MOVE IT FROM SHED
0960        LXI   H,SHED
0970 FIRE   MOV   A,M     LIGHT FIRE
0980        INX   H
0990        XCHG
1000        MOV   M,A     ..MOVE IT
1010        INX   H
1020        MOV   A,H
1030        XCHG
1040        CPI   0D0H    END OF YARD?
1050        JNZ   FIRE    NO, MAKE MORE STEAM!
1060        CALL  TRAVL   GO TAKE TRIP
1070        JMP   HOSTLE  NO ROUND TRIPS, JUST DO
                            AGAIN
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00ED                    1080 *
00ED 01 40 03           1090 TRAVL  LXI   B,64*13 MAKE TRIP 13 MILES

00F0 C5                 1100 CHOO   PUSH  B       CHUFF ONCE
00F1 CD FF 00           1110        CALL  STROK   MAKE FORWARD MOTION
00F4 CD 0F 01           1120        CALL  TURN    TURN WHEELS
00F7 C1                 1130        POP   B
00F8 0B                 1140        DCX   B       CLICK ODOMETER
00F9 AF                 1150        XRA   A
00FA A8                 1160        XRA   B       13 MILES YET?
00FB C2 F0 00           1170        JNZ   CHOO    NO
00FE C9                 1180        RET   *       DO NEXT TRIP
00FF                    1190 *
00FF 21 01 CC           1200 STROK  LXI   H,0CC01H MOVE DOWN THE TRACK
0102 0E D0              1210        MVI   C,0D0H
0104 7E                 1220 COAL   MOV   A,M     ADD MORE COAL
0105 2B                 1230        DCX   H
0106 77                 1240        MOV   M,A
0107 23                 1250        INX   H
0108 23                 1260        INX   H
0109 7C                 1270        MOV   A,H
010A B9                 1280        CMP   C       ENOUGH COAL?
010B C2 04 01           1290        JNZ   COAL    NO, PUT MORE ON!
010E C9                 1300        RET
010F                    1310 *
010F 21 00 CC           1320 TURN   LXI   H,0CC00H TURN WHEELS
0112 7E                 1330 HISS   MOV   A,M
0113 23                 1340        INX   H
0114 FE 06              1350        CPI   6       FIND COWCGTCHER
0116 C2 12 01           1360        JNZ   HISS    LOOK AGAIN
0119 23                 1370 FOUND  INX   H
011A 7E                 1380 AXLE   MOV   A,M
011B FE 11              1390        CPI   11H     WHAT QUARTER TURN?
011D C2 31 01           1400        JNZ   NXT1
0120 11 7E 14           1410        LXI   D,147EH NEXT QUARTER TURN
0123                    1420 *
0123 06 07              1430 AXL1   MVI   B,7     DO 4 AXLES
0125 72                 1440 AXL2   MOV   M,D     WHEELS MOVED HERE
0126 05                 1450        DCR   B       LAST WHEEL?
0127 CA 52 01           1460        JZ    WORK    I'VE BEEN WORKIN'...
012A 23                 1470        INX   H       ..ON THE RAILROAD..
012B 73                 1480        MOV   M,E     (SIDE RODS MOVED HERE)
012C 23                 1490        INX   H       ..ALL THE LIVE..
012D 05                 1500        DCR   B       ..LONG DAY.....
012E C2 25 01           1510        JNZ   AXL2
0131                    1520 *
0131 FE 14              1530 NXT1   CPI   14H     QUARTER TURN
0133 C2 3C 01           1540        JNZ   NXT2
0136 11 2D 13           1550        LXI   D,132DH
0139 C3 23 01           1560        JMP   AXL1
013C FE 13              1570 NXT2   CPI   13H     QUARTER TURN
013E C2 47 01           1580        JNZ   NXT3
0141 11 5F 12           1590        LXI   D,125FH
0144 C3 23 01           1600        JMP   AXL1
0147 FE 12              1610 NXT3   CPI   12H     QUARTER TURN
0149 C2 1A 01           1620        JNZ   AXLE
014C 11 2D 11           1630        LXI   D,112DH
014F C3 23 01           1640        JMP   AXL1
0152                    1650 *
0152 01 B8 0B           1660 WORK   LXI   B,3000
```

```
0155 0B                 1670 OIL    DCX    B,
0156 DB 00              1680        IN     0       DID THE CONDUCTOR
0158 E6 40              1690        ANI    RDA     ..FLAG US DOWN?
015A C2 63 01           1700        JNZ    QUIT    QUITTIN' TIME
015D AF                 1710        XRA    A       NO, THEN HIGHBALL
015E A8                 1720        XRA    B
015F C2 55 01           1730        JNZ    OIL     NO SQUEEKS, PLEASE!
0162 C9                 1740        RET
0163                    1750 *
0163                    1760 * PUT A JUMP TO WHEREVER YOU NEED TO RETURN
                                                    IN THE NEXT
0163 C3 60 E0           1770 QUIT   JMP    ALSB    ..YOUR RETURN LINK GOES
                                                    HERE
0166                    1780 *
0166                    1790 RDA    EQU    40H     PUT YOUR DATA READY FLAG
                                                     HERE
0166                    1800 RRY    EQU    0CC00H
0166                    1810 SMOKE  EQU    6FH     SMOKE CHARACTER
0166 01 10              1820 CAB1   DW     1001H   CAB DESCRIPTION
0168 10 5D              1830 CAB2   DW     5D10H   "   "
016A 7E 20              1840 CAB3   DW     207EH   "   "
016C 28 0A              1850 BOI1   DW     0A28H   BOILER DESCRIPTION
016E 0A 19              1860 BOI2   DW     190AH   "       "
0170 0A 0A              1870 BOI3   DW     0A0AH   "       "
0172 0A 5B              1880 BOI4   DW     5B0AH   "       "
0174 39 39              1890 BOI5   DW     3939H   "       "
0176 5D 20              1900 BOI6   DW     205DH   "       "
0178 06 20              1910 FRA1   DW     2006H   FRAME DESCRIPTION
017A 11 2D              1920 FRA2   DW     2D11H   "       "
017C 11 20              1930 FRA3   DW     2011H   "       "
017E 6F 2D              1940 FRA4   DW     2D6FH   "       "
0180 6F 20              1950 FRA5   DW     206FH   "       "
0182 19 19              1960 TIES   DW     1919H   TIES DESCRIPTION
0184 00                 1970 SHED   NOP    *       THIS IS SHED AREA
0185                    1980 CLOUD  EQU    $+0172H  BEGINNING OF CLOUD
0185                    1990 *
0185                    2000 .
```

```
:1A000000AFD3C821840101000836202308AFA8C2090021F702110000060E05
:1A001A00CD5000112800060CCD5000113000060DCD5000113400060E4CD506B
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:1A0068002A66012AE042A68012280042A6A012282042A6C012E5042A6E09
:1A0082000122E7042A7001122E9042EB042A7201122ED042A7401122EF042A0D
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:1A0104007E2B7723237CB9C2040100921000CC7E23FE06C2120123237EFE11C2DD
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:1A013800130323001FE13C2470111F12C323001FE12C21A011112D11C323010C
:1A0152000138B0B0BD300F640C26301AFA8C2550100C9C3E00110105D7E2046
:19016C00280A0A190A0A0A5B39395D2006201120D11206F2D6F201919000C3
:00
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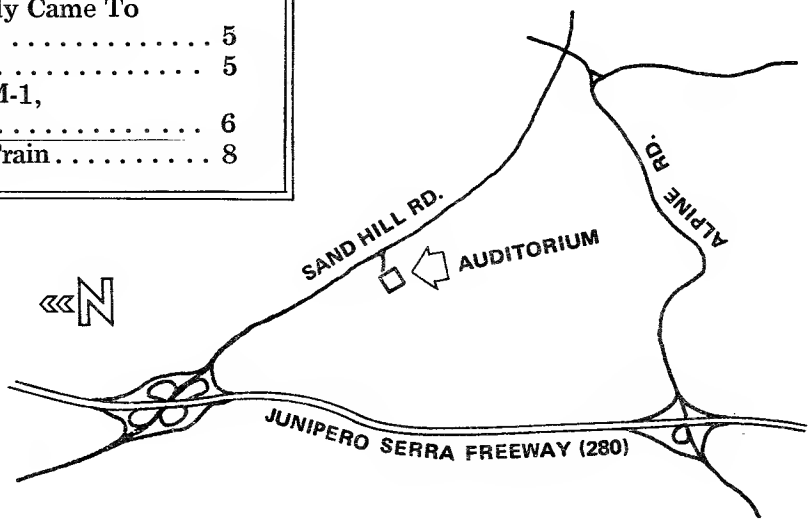
HOMEBREW COMPUTER CLUB MEETINGS

Where & When

The Homebrew Computer Club meets a 7 p.m. at the Stanford Linear Accelerator Center Auditorium. Dates scheduled for the remainder of this year are December 10 and 22. The date and location are subject to change. If a change does occur, every effort will be made to provide advance notice in the Newsletter.



HOMEBREW COMPUTER CLUB
NEWSLETTER

P.O. Box 626
Mountain View, CA 94042

FIRST CLASS MAIL

STAND-ALONE ADAPTER FOR VDM-1

By Lee Felsentein

This circuit allows the operation of the Processor Technology VDM-1 as a stand-alone terminal. It includes a UART for serial data communication with EIA RS-232 signal levels. All data to the VDM comes through the UART, so a "local loopback" connection is necessary from the Data Out terminal to the Data In for half duplex operation. Two switchable Baud rates are available if a SPDT switch is connected to switch Baud Rtn to Baud 1 or Baud 2. The Ready output from the UART allows operation from a generalized parallel interface at maximum speed. The Break input moves the output to a space condition and is used as an escape character in various systems.

The circuit requires a connection to an external -16 V to -19 V supply; +5 V power is supplied by pin 16 of IC23 from the regulator of the VDM. The circuit draws very little current since most logic is CMOS. The -12 V and +5 V connections shown are for keyboard power.

On power-up, the circuit initializes to a clear screen with a cursor in the lower left corner. Non-control characters are displayed and rolled up when a 64 character line is filled. CR will terminate a line and roll it up. A LF immediately following the CR will be ignored, as will a LF following any number of DEL (rub-out) characters which in turn follow a CR. A second LF, or one without a CR preceding, will be treated like a CR-LF combination. FF will initialize the screen.

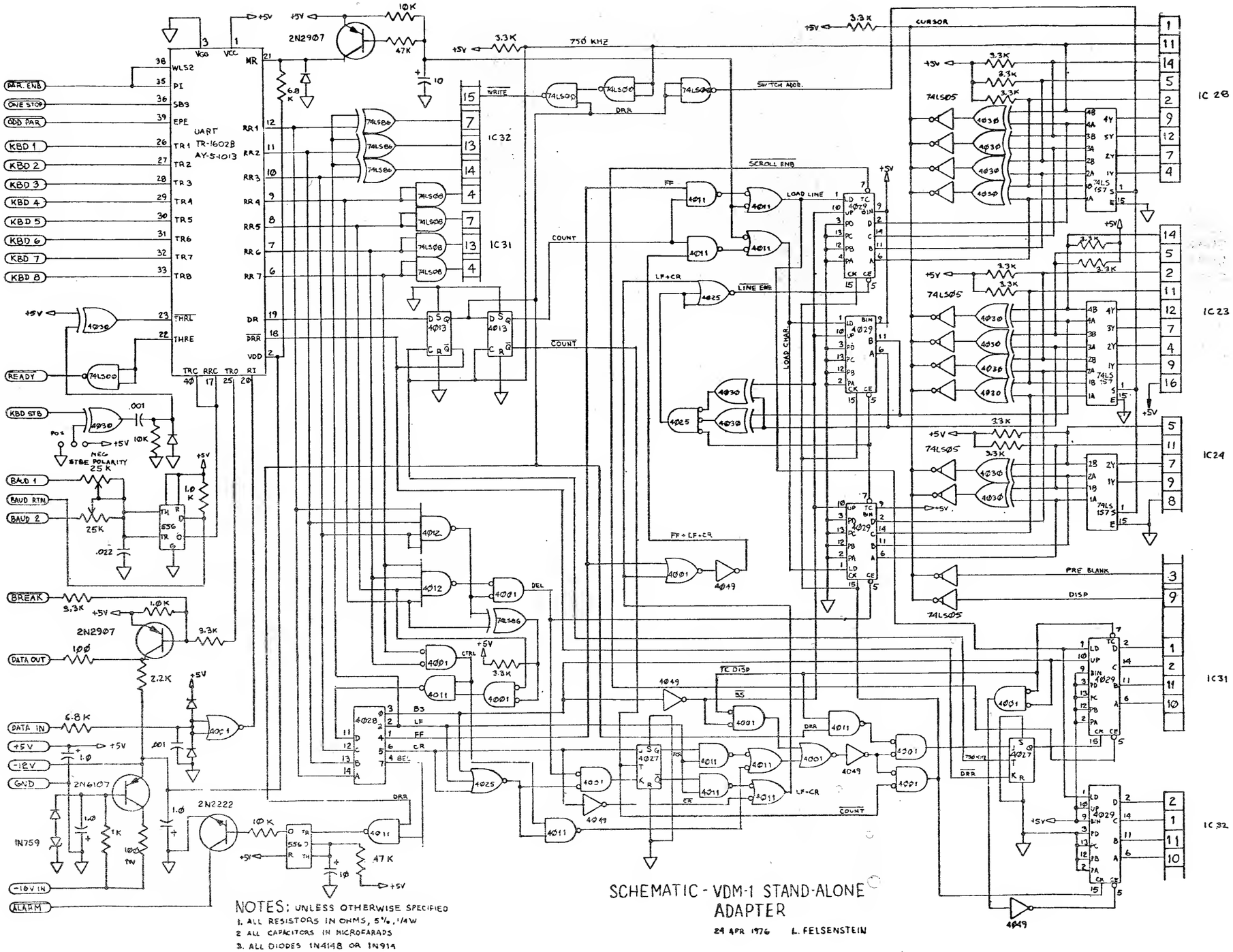
BS will be recognized and the cursor will move back and will erase the last character. At the left end of the line the cursor will jump to the right end and will cause a roll down of the line above. This will not occur if there is not text on the line above. The cursor will jump to the 64th location whether or not it is visible there. If the previous line was terminated by a CR, the cursor disappears until backed over the CR.

The circuit may be constructed using wire-wrap or solder; layout is not critical except that proper supply bypassing techniques must be used for the TTL ICs. Capacitors (0.1μF) should be connected between the +5 V and GDN pins of these ICs to prevent supply current pulses.

The two boards may be interconnected with ribbon cables and DIP headers which plug into the IC sockets indicated on the drawing.

THE FOLLOWING MODIFICATIONS TO THE VDM ARE NECESSARY

1. Cut trace on solder side from pin 4 of IC 17.
2. Cut trace from pin 13 of IC 10 on component side.
3. Connect a jumper from pin 6 of IC 17 to pin 13 of IC 10.
4. Connect a jumper from pin 7 of IC 31 to pin 4 of IC 17.
5. Connect a jumper from pin 3 of IC 31 to pin 7 of IC 13.
6. Connect a jumper from pin 8 of IC 15 to pin 9 of IC 31.
7. Connect a jumper from pin 3 of IC 41 to pin 15 of IC 31.
8. Remove ICs 18, 23, 24, 28, 29, 31, 32, 33, 34, 35, 37, 38, 39 and 40.
9. If not yet installed, resistors R27 through R32 and R41 through R48 may be omitted from assembly. □



NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTORS IN OHMS, 5%, 1/4W
2. ALL CAPACITORS IN MICROFARADS
3. ALL DIODES 1N4148 OR 1N914

SCHEMATIC - VDM-1 STAND-ALONE ADAPTER

24 APR 1976 L. FELSENSTEIN